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UNIVERSITY OF JYVÄSKYLÄ

Potential of Plastics in Removal of Harmful Substances and Heavy Metals from Wastewaters

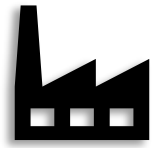
PlastLIFE annual seminar 2024

Kia Koskinen and Siiri Perämäki

Pathway of Contaminants to the Environment

Contaminant sources

- Households
- Industry
- Agriculture
- Healthcare
- Etc.

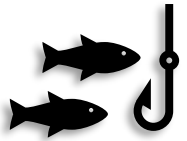


Wastewater treatment plants

- Primary, secondary, tertiary treatment
- Effective removal of some contaminants
- Limited and insufficient treatment for certain contaminants (microcontaminants)

Environment

- Effluents from WWTPs
- Runoffs and point sources
- Contaminants from effluents

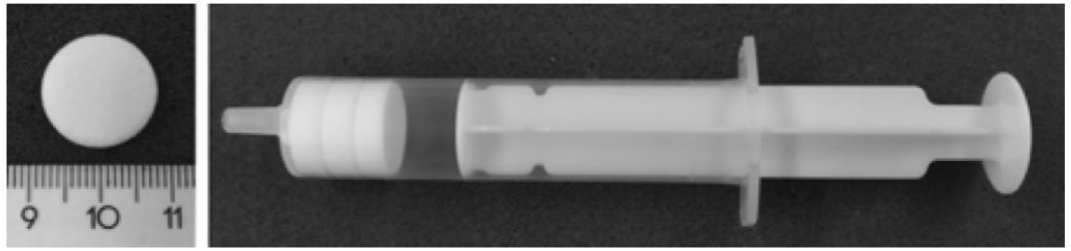


Impact

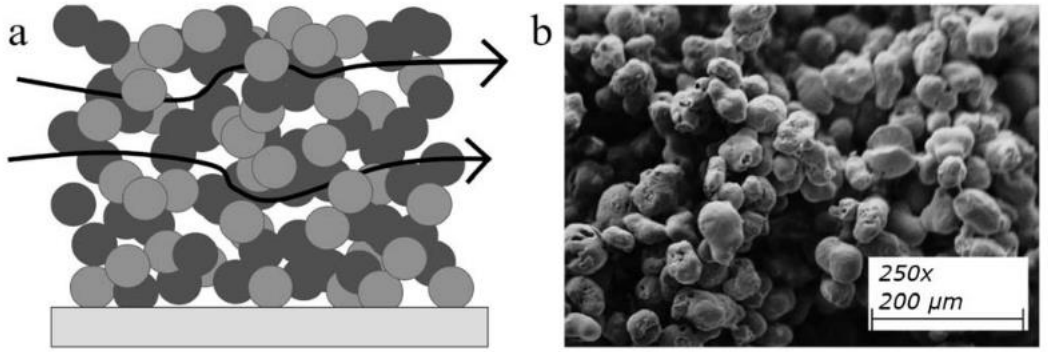
- Endocrine disruptors affecting wildlife
- Persistency
- Accumulation
- Toxicity

Background for Removal of Contaminants Using Plastics

- 3D printed scavenger technology developed at JYU
- Active filters remove contaminants/valuables from solutions
- Contaminants can be washed from filters
- Reusable for multiple cycles



Scavenging filters fitted in a syringe.



(a) Simplified cross-section of 3D-printed material showing solvent flow-through. (b) Break surface of polyamide-12 filter

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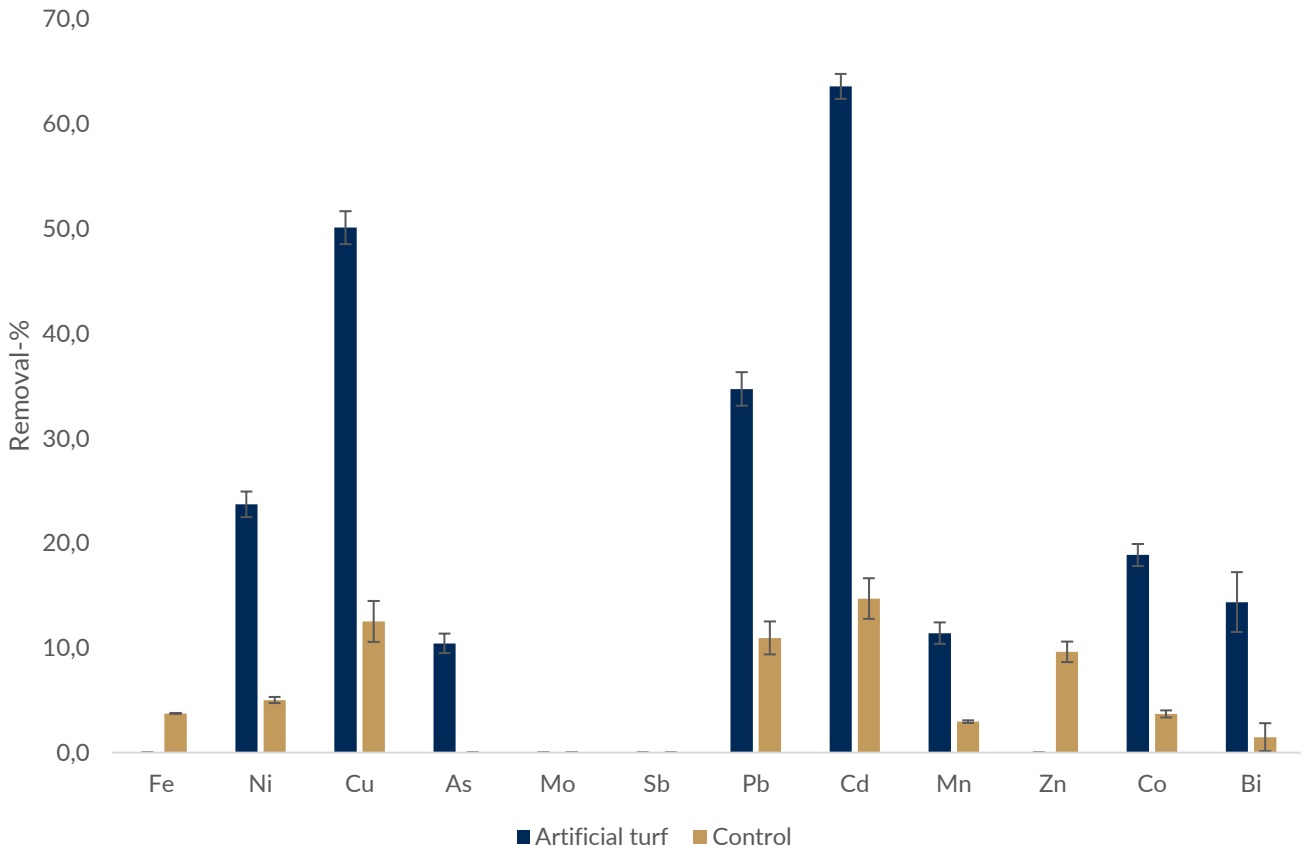
Waste Plastics for Removal of Harmful Substances?

Case I: Heavy metals

Removal of Heavy Metals from Lake Waters using Artificial Turf



Reetta Mattila ”Raskasmetallien adsorboituminen muoveihin”, Master’s thesis, University of Jyväskylä, 2024.

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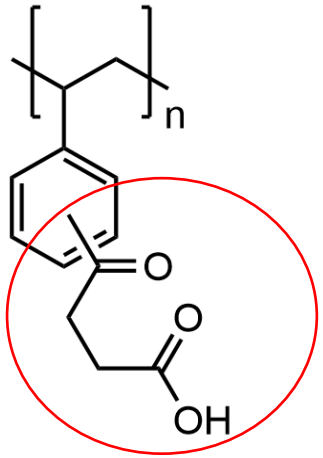
Waste Plastics for Removal of Harmful Substances?

Case II: Pharmaceuticals

Potential of Modified Plastics in the Removal of Pharmaceuticals

Friedel-Crafts acylation of polystyrene

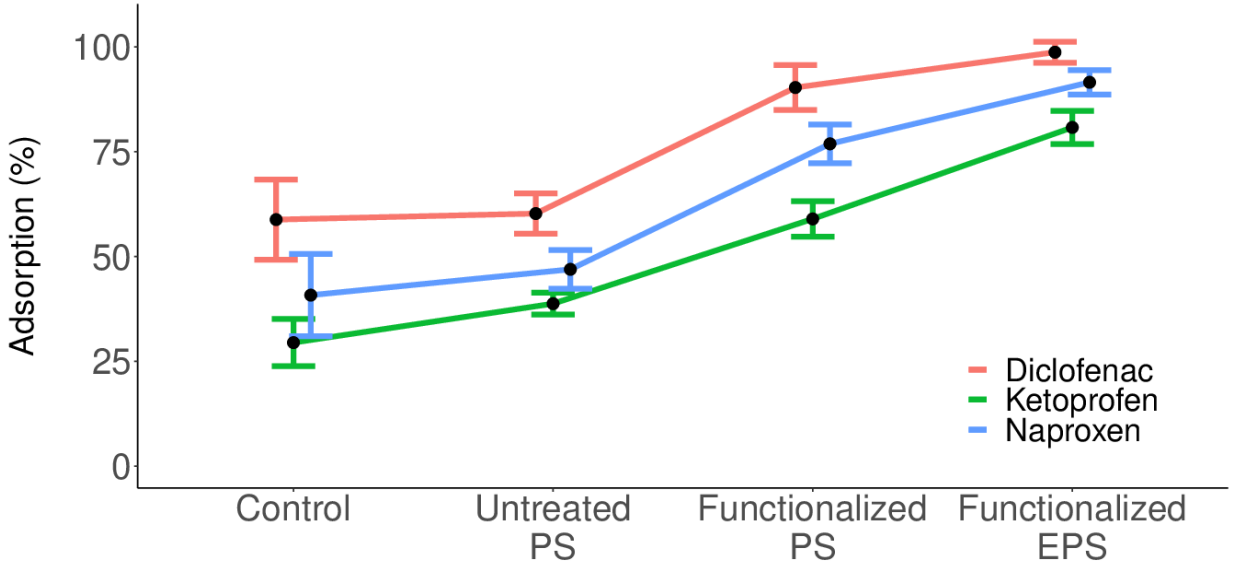


Acylated polystyrene

Increased functionality
→ more interactions with pharmaceuticals

- Yields powderous polymer material
- Good performance in adsorption studies of selected pharmaceuticals
- Possible applications for example in 3D-printing of scavenging filters

Adsorption capacity of acylated polystyrene



PS = polystyrene powder
EPS = recycled expanded polystyrene, ”styrox”

What's Next?

- 3D printing studies with promising plastics (unmodified and modified)
- Trials with simulated and real wastewaters
- Further screening of pharmaceutical adsorption on plastics
- Functionalization of different plastics and with different functionalities

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Thank you for your attention!

For more info on JYU-Chemistry project: